



## Incidence and Risk Factors for Systemic Infection in Deceased Donors

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### ABSTRACT

**Background.** Organ donation shortage is the primary barrier to all organ transplantations. Infectious disease transmission through transplantation is considered controversial for organ retrieval. Donors with bacteremia and sepsis are considered controversial for organ retrieval due to potential transmission of an infectious agent to the recipient.

**Methods.** We retrospectively reviewed the results of bacterial culture of the donor's blood from peripheral venous or central venous catheter, urine, and bronchial aspiration from the organ donation registries of 102 potential donors from the Ministry of Health and Tissue Transplant Coordination Center of Istanbul Region in 2015.

**Results.** Of the 102 deceased donors included in the analysis, 24 (23.5%) had infection. The most common sites of infection were the bloodstream (41.6%) and the respiratory system (37.5%). The most common isolated pathogens of the bacterial cultures were Gram-positive bacteria (21), Gram-negative microorganisms (14), and *Candida* (1). The significant risk factor for infection was duration of stay at the intensive care unit (median: 5 day; 25–75%: 3–5 day) (odds ratio, 2.94; 95% confidence interval, 1.06–8.12;  $P < .05$ ). The presence of infection in the donor accounted for a significant part of the reasons why the organs were not accepted for transplantation (kidneys 9%, liver 4%, heart 6%).

**Conclusions.** The study showed that deceased donors with prolonged stays in the intensive care unit have an increased risk for developing nosocomial infections; so there is a need for establishing and enforcing the prevention and control of infection in possible donors.

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**F**OR SOME end-stage diseases, transplantation is the treatment of choice, but organ donation shortage is the primary barrier to organ transplantations. Improving the quality of deceased, potential donors could alleviate the disproportion between the supply and demand of transplant organs. The organ or tissue to be transplanted should not carry unacceptable risks. Infection transmission through transplantation is an ongoing concern, and identifying donor risk factors for infection and monitoring of pre-donation cultures are essential. For this reason, 2 blood

cultures and 1 urine culture should be performed for all potential donors [1]. If an infection is suspected, then cultures from other body sites should be performed. The

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results of these cultures must be supplied to the transplantation teams.

There is a high prevalence of infection and sepsis in Turkish intensive care units (ICU) [2], and there is a lack of information about the infection prevalence among donors in our country. This study aimed to demonstrate the prevalence of infection in the potential donors treated in ICUs of Istanbul region.

## METHODS

In this retrospective prevalence study, data from the year 2015 were obtained from the organ donation registries of the Ministry of Health and Tissue Transplant Coordination Centre of the Istanbul Region. The results of bacterial cultures of the potential donors' blood from the peripheral venous or central venous catheter, urine, rectal swaps, and bronchial aspiration were reviewed. The following variables are described: age, sex, cause of death, length of stay (LOS) at the intensive care unit, and the duration of intubation. All registered brain death donors, regardless of their age, were evaluated.

Patients' characteristics and results are described as absolute numbers, percentages, and mean with absolute minimum and maximum. Variables were reported as median and interquartile range. Chi-square test for categorical variables was used. A value of  $P < .05$  was considered statistically significant.

## RESULTS

In this study, 102 donors were evaluated. The mean age was  $50.19 \pm 18.92$  years, with 62% male. The mean duration of stay at the intensive care unit (mean  $\pm$  SD) was  $5.43 \pm 4.29$  days, and the duration of intubation was  $5.27 \pm 4.14$  days (mean  $\pm$  SD). The significant risk factor for infection was the duration of stay in the ICU (median: 5 days; 25–75%: 3–5 day) (odds ratio, 2.94; 95% confidence interval, 1.06–8.12;  $P < .05$ ). Cerebrovascular accident ( $n = 58$ ) was a prominent diagnosis followed by polytrauma with brain trauma ( $n = 13$ ) and isolated brain trauma ( $n = 10$ ). Of the donors included in the analysis, 24 (23.5%) had an infection. The most common sites of infection were the bloodstream (41.6%) and respiratory system (37.5%). Of the positive isolates, 21 were Gram-positive, 14 were Gram-negative, and 3 were *Candida* (Table 1). About 57% of the Gram-positive isolates were *Staphylococcus* spp., and 36% of the Gram-negative isolates were *Klebsiella* spp. More than half of the patients (60%) were receiving at least 1 antimicrobial agent. At the time of data collection, the number of cultures taken were 141, and the results of cultures were 23% positive, 58% negative, and 19% of the results of cultures taken were missing. Presence of infection in the donor accounted for a significant part of the reasons why the organs were not accepted for transplantation (kidneys 9%, liver 4%, heart 6%). Only 1 kidney recipient died on the 26th day after the surgery due to septic shock; but information about the microorganism causing septic shock could not be obtained. Recipients of livers and lungs from infected donors had no complications related to transplantation. On postoperative day 9, 1 heart recipient

**Table 1. Microorganisms and Origin of Infections**

	Bloodstream	Respiratory
Gram positive	20	1
Staphylococcus	12	
Streptococcus	5	1
Cocci Gram positive, others	1	
Neisseria meningitidis	1	
Gram negative	9	5
Escherichia coli	2	
Enterobacter (any type)	1	
Klebsiella	4	1
Serratia		1
Pseudomonas aeruginosa	2	1
Acinetobacter		1
Gram negative, others		1
Candida	3	

died, although no information was available about the cause; and on the 22nd day after the surgery, 1 recipient, who had kidney and liver transplantation, died due to a non-infection cause.

## DISCUSSION

Prolonged hospital stays of organ donors and transplant candidates is associated with colonization with antimicrobial-resistant organisms [3]. In our study, the mean length of stay (LOS) at the ICU was  $5.43 \pm 4.29$  days and the mean duration of intubation was  $5.27 \pm 4.14$  days. It is revealed that the significant risk factor for infection was LOS at the ICU (median: 5 days; 25–75%: 3–5 days) (odds ratio 2.94; 95% confidence interval, 1.06–8.12;  $P < .05$ ). In Paredes' study, donors with bacteremia had an average LOS of 3 days (interquartile range: 2–7 days) [4].

Bacteremia and sepsis are major concerns during organ retrieval as they may cause transmission of the infection that may result in complications, graft failure, or death [5]. As there is a disparity between demand and supply of organs, the criteria to become a donor can be expanded by including marginal older donors, donors with systemic infection, and so on. Yuan et al revealed in their study that organ donation from donors with systemic infection is not contraindicated [5]. Although it is not contraindicated, due to the deleterious effects, potential donors should be evaluated for infection. The analysis of data that we reached revealed that recipients who had transplantation from infected donors had the same mortality and rejection rates as the ones who had transplantation from non-infected donors.

The most common microorganisms isolated in ICUs were 78.7% Gram-negative and 15.5% Gram-positive with a mean LOS of 27 days [2]. In our study, the mean LOS was 5 days and the organisms isolated were 55% Gram-positive and 37% Gram-negative. The difference of the microorganisms isolated may be due to the shorter LOS of the donors.

In Turkey, all potential donors are treated in ICUs; their metabolic state and infections are closely monitored.

Our study revealed that at the time of data collection, 19% of the result of cultures taken were missing and, in some of the donors, there was no evidence that any cultures were taken. The percentage of donors receiving antimicrobial therapy at the time of harvesting was higher as compared to the Yuan et al study (60% and 28.1%, respectively) [5].

For better outcomes, donor management should be done according to protocols that are widely accepted by the intensivists. Results of the tests and cultures should be shared with the organ procurement team, and the results that have not been revealed at the time of harvesting should be shared with the recipient team [6,7]. A recipient's treatment should be tailored according to the cultures results. Delayed results, recognition, and therapy may play a role in increased mortality associated with infections in transplant recipients [3].

Paredes et al revealed cerebrovascular accident as the leading cause of brain death. In our study, it was also the major cause, 60% and 57% respectively [4]. Also, the mean ages of the donors were similar with this study. Although bloodstream infections were the main causes of infection in both studies, the percentages (14% vs 41.6%) were different. The longer LOS in our study may cause a wide gap. The potential donor diagnosis should be made promptly to avoid higher risk of infection.

There are several limitations in our study. Firstly, our data collection came from handwritten medical records, which had missing results and, as it is a retrospective study, we were unable to find these missing data. Secondly, for our

study, we could not evaluate in detail the organ receivers' follow-ups.

## CONCLUSION

Deceased donors have an increased risk for developing nosocomial infections with a prolonged stay at the ICU, so there is a need for establishing and enforcing the prevention and control of infection in possible donors.

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